Office of National Marine Sanctuaries/National Centers for Coastal Ocean Science Long-term Agreement (ONMS/NCCOS LTA)

2005 Annual Liaison Report on Existing and Potential ONMS/NCCOS Collaborative Studies at the Stellwagen Bank National Marine Sanctuary (SBNMS)

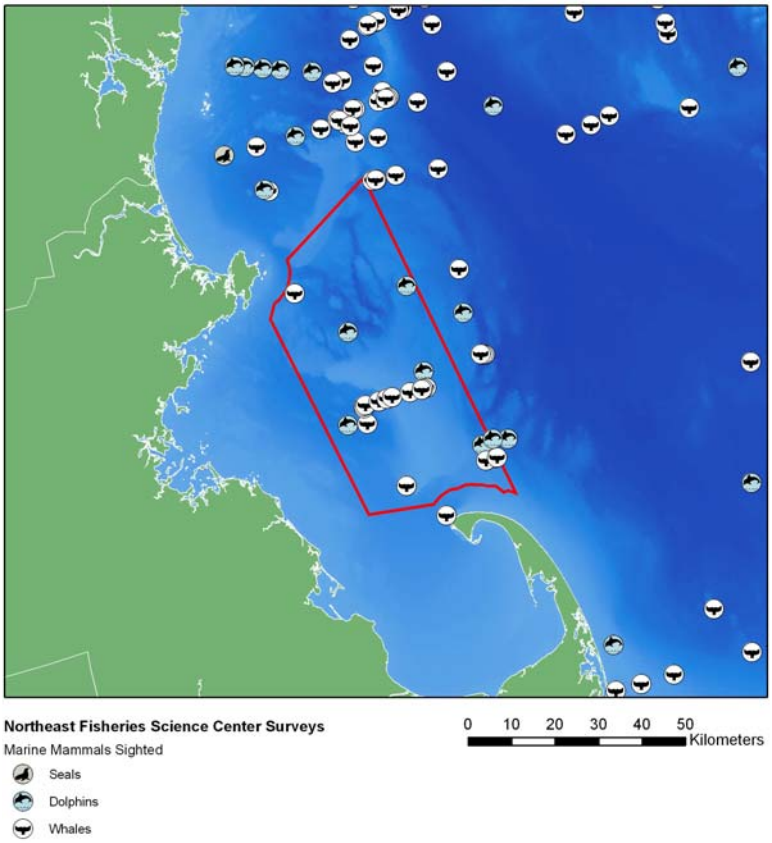
Prepared by:

Timothy A. Battista
National Centers for Coastal Ocean Science (NCCOS)
Center for Coastal Monitoring and Assessment (CCMA)
and
David Wiley, Research Coordinator SBNMS

January 2006

DESCRIPTION

The National Centers for Coastal Ocean Science (NCCOS) Biogeography Program (BP), in consultation with Stellwagen Bank National Marine Sanctuary (SBNMS) and the Office of National Marine Sanctuaries (ONMS), will conduct a spatially-explicit characterization of the physical and biological conditions within SBNMS ecosystems. Preliminary efforts included the integration of existing coverages (i.e. sediment type, bathymetry, shoreline, and shipping lanes) into a Geographic Information System (GIS) environment with select SBNMS supplied biological and human-use datasets. As working group discussions progress, maps and basic spatial analyses will be conducted on this data as requested by SBNMS staff. The BP, in consultation with SBNMS science staff, will continue to obtain data on the biology, human use, and physical oceanography of the area. A characterization of the physical oceanographic conditions of SBNMS will be conducted following an evaluation of the extent and compatibility of available data. Finally, the oceanographic assessment will be analyzed in concert with the biological and human use data sets to examine relationships between oceanography and the temporal and spatial dynamics of the ecosystem.



FY2005 Accomplishments

Year 3 Goal to be conducted by the Center for Coastal Monitoring and Assessment (CCMA) (Biogeography Team- BT, Remote Sensing Team – RST, and National Status and Trends Team – NS&T) in collaboration with SBNMS will be to complete an analysis of the physical oceanographic conditions in the region, and conduct a Biogeographic Assessment of key biological and physical relationships within the sanctuary. CCMA accomplishments include the development of a synoptic characterization of physical oceanographic conditions in SBNMS and the Gulf of Maine by synthesizing existing available information, assembling satellite and *in situ* sensor datasets, and perform preliminary analysis with these data in order to identify seasonal, annual, inter-annual, and event driven patterns.

FY2006 Planned Activities

Beginning the first quarter of FY2006, data will be analyzed and serve as the basis for a technical report to the sanctuary. The report and publications will contain chapters on the following

topics: Physical Oceanographic Conditions, Characterization of Seabirds and Marine Mammals, Characterization of Fish and Invertebrates, and a Characterization of Chemical Contaminants. The final product will include production of a digital report, delivery of all raw data used for analysis, delivery of derived GIS data in a Geodatabase, and Federal Geographic Data Committee (FGDC) metadata all of which is expected to be completed in the third quarter of FY2006.

YEAR 3 - Workplan - A Biogeographic Assessment (BA) of
Stellwagen Bank National Marine Sanctuary

GOAL

Year 3 Goal to be conducted by CCMA (Biogeography Team- BT, Remote Sensing Team – RST, and National Status and Trends Team – NS&T) in collaboration with SBNMS will be to complete an analysis of the physical oceanographic conditions in the region, and conduct a Biogeographic assessment of key biological and physical relationships within the sanctuary. Both topics were identified by the Sanctuary at the beginning of the CCMA/SBNMS agreement as necessary end deliverables and incorporate many of the identified, targeted biogeographic issues.

STATUS

A bi-annual meeting was conduct May 25, 2005 at SBNMS. CCMA presents an approach and timeline for conducting a Biogeographic Assessment; provide a status for progress; provide corrective measured for product delays; and receive input, suggestions, and agreement from Sanctuary staff for Year 3 activities.

Corrective measures were necessary in order to compensate for changes in the management plan review schedule, loss of key CCMA staff assigned to the SBNMS efforts, delay in receiving NMS funds, reduction in requested NMS funds, and delay in getting additional experts to engage in BA efforts.

Physical Oceanographic Conditions

CCMA has been delayed in providing the Year 2 product. These delays are largely due to the collective decision to incorporate the participation of the CCMA Remote Sensing Team (RST). RST is a highly respected group in the realm of remote sensing and have made significant progress in developing products that integrate and characterize climatological and oceanographic conditions at Sanctuary-proper and regional scales appropriate for Sanctuary managers. In consultation with SBNMS, CCMA incorporated the participation of RST. Although, the participation of RST will provide for a better final product, there was considerable delay exercising RST capacity to conduct the work.

Characterization of Biota

CCMA has made excellent progress in identifying, acquiring, and analyzing the necessary, available, and useful datasets for the Sanctuary-proper and Gulf of Maine region. The attached timelines provide an estimate of project milestones. There has been some delay in investigating biological linkages with the physical environments due to the aforementioned issues.

Physical Oceanographic Conditions; Goal - Develop a synoptic characterization of physical oceanographic conditions in SBNMS and the Gulf of Maine by synthesizing existing available information, assembling satellite and *in situ* sensor datasets, and perform preliminary analysis with these data in order to identify seasonal, annual, inter-annual, and event driven patterns. This effort involves the assimilation of methodologies developed and conducted by RST and data analysis of external datasets gathered by BT. Phase 1 products include: monthly, seasonal, and annual means by year; monthly and seasonal grand means for sea surface temperature, turbidity, chlorophyll a, winds, and precipitation. Phase 2 products will include anomaly analysis; spatial and temporal depiction of climatological event and persistence; and the identification of oceanographic fronts (draft). BT has focused on identifying and assimilating *in situ* datasets from a variety of institutions including drifter data, CTD (conductivity, temperature, depth) data, zooplankton datasets, and modeled current velocities. In addition, CCMA has brokered the assistance of Jim Manning, Woods Hole Oceanographic Institute (WHOI) to provide expert guidance in the identification of relevant datasets, appropriate analytical techniques and evaluation results and interpretations. Expected products will include a chapter containing the analysis results, methods, and discussion as well as metadata, raw and processed digital data to be made available to the sanctuary.

Characterization of Seabirds and Marine Mammals: Goal - Characterize the locations of seabird and marine mammal species within the Stellwagen Bank NMS and the surrounding Gulf of Maine region and supply marine bird and mammal species level spatial and temporal assessment information for sanctuary management purposes. This portion of the overall Stellwagen Bank NMS Biogeographic Assessment will focus on marine birds including alcids, gannets, greater shearwaters, petrels and terns as well as marine mammals such as whales, delphinids, and pinnipeds. It will use datasets containing marine bird and mammal sightings from a number of sources, the majority of which have been obtained from the OBIS-SEAMAP website (http://seamap.env.duke.edu/). This includes datasets from the NOAA Northeast Fisheries Science Center, PIROP (Programme Integre recherches sur les oiseaux pelagiques), CETAP (Cetacean and Turtle Assessment Program), and YoNAH (Years of the North Atlantic Humpback Whale). These data, when corrected for effort, will be used to display presence/absence and relative abundance of selected individual species and groups of species (ex: all alcids) according to season and persistence over time. Analysis will include exploration of species spatial patterns in relationship with oceanographic features, such as sea surface temperature, frontal boundaries, and anomalies, as well as measures of marine bird and mammal biological diversity within the Sanctuary and throughout the Gulf of Maine region. Assistance will be provided by Falk Huettmann, Ph.D., of the University of Alaska-Fairbanks, for the seabirds section of the report, as he is a leading expert in the use of marine bird sightings data for analysis and modeling purposes, and in particular, using the PIROP dataset. Currently, a review of survey methods to aid in the creation of relative abundance maps is underway. Expected products will include a chapter containing the analysis results, methods, and discussion as well as metadata and other GIS-analysis products to be made available to the sanctuary.

Characterization of Fish and Invertebrates: Goal - Conduct a marine biogeographic analysis of available data to identify important ecologically significant regions and time periods, based on species distributions, abundance, associated habitats, and their ecological function. Produce a summary assessment report of the GIS analyses and results. As part of the biological component of the biogeographic characterization, an exhaustive data search was conducted for fishes and macro-invertebrates with the study area. Potential data holders include: National Marine Fisheries Service, Massachusetts Division of Marine Fisheries, New England states natural resource agencies, universities, and other federal and state agencies. Similar to the analyses conducted for west coast sanctuaries (Cordell Bank, Gulf of the Farallones, Monterrey Bay, Channel Islands) fish and invertebrate data will be analyzed to determine community metrics (species diversity and richness), species assemblages, and association with abiotic and biotic factors (chlorophyll a, temperature gradients, prey availability, current dynamics). In consultation with SBNMS, a targeted species list was developed to focus the effort. In addition to the State and Federal fishery independent datasets, BT will incorporate Year 1 efforts analyzing fishery dependent Vessel Trip Report data, and will include a spatio-temporal analysis of available icthyoplankton and zooplankton data. The quantity and quality of the data will determine analytical procedures. Expected products will include a chapter containing the analysis results, methods, and discussion as well as metadata and raw and GIS-based analysis to be made available to the sanctuary.

Characterization of Chemical Contaminants; Goal- Determine the spatial extent of contamination in Stellwagen Bank NMS, Cape Cod Bay, Massachusetts Bay and Boston Harbor sediments and at selected locations in blue mussels and benthic fish. A secondary goal is to determine whether the building of Boston's Massachusetts Bay sewage outfall is exporting contaminants into the deeper waters of Massachusetts Bay. Chemical contaminants determined are polycyclic aromatic hydrocarbons, PCBs, DDT and its metabolites, other chlorinated pesticides and trace elements such as arsenic, cadmium, mercury and silver. There are three field components to this activity. Depositional surficial sediments were collected using the RV Nancy Foster in June 2004 and characterized for the above contaminants. Sampling sites were selected using a stratified random sampling design that will allow for the determination of the areal extent of contamination within each of five zones. Areas for which contaminants were quantified follow the geographic areas listed above with the addition of an area defined as "area between bays". Sediments were also collected at each site for the characterization of infaunal biota. Species assemblages and the quantity of organisms present in sediments provide additional information to help determine areas of degraded sediments. Blue mussels have been collected along the New England shoreline and analyzed for contaminants since 1986 with the most recent sampling having occurred during the winter of 2005. These data will also be used to help determine regional contaminant trends. The final field component of this characterization involves the collection of benthic fish and associated surficial sediments. The historical data for this project cover the timeframe of 1984 to 1991. Benthic fish were again sampled at the Deer Island National Benthic Surveillance site and sampled for the first time at the new Massachusetts Bay sewage outfall. Fish samples are being quantified for same list of contaminants as are sediment and mussel samples with the exception of the polycyclic aromatic hydrocarbons, which are metabolized in fish liver. NOAA's National Marine Fisheries Service is also determining the

extent of fish diseases present in fish from these two sites. Data from this effort will be put into a broader context using data derived from other sources including contaminant data that may have resulted from the Massachusetts Bay sewage outfall permitting process.

CONTACTS

Office of National Marine Sanctuaries
David Wiley, Research Coordinator
Stellwagen Bank National Marine Sanctuary
PH: (781) 545-8026 ext. 211
Internet Address: David.Wiley@noaa.gov
http://stellwagen.noaa.gov/

National Centers for Coastal Ocean Science
Dr. Timothy A. Battista
Center for Coastal Monitoring and Assessment
PH: (301) 713-3028 ext. 171
Internet Address: Tim.Battista@noaa.gov
http://www.ccma.nos.noaa.gov/